

Empty Calories in El Paso County:
*A Spatial Analysis of Food Health Hazards in Public
School Zones*

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On my honor
I have neither given nor received
unauthorized aid on this thesis.

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ABSTRACT: Many urban areas in the United States suffer both from a lack of access to supermarkets and healthy food and from an overabundance of affordable and convenient unhealthy food options. As a result, many public schools are within walking distance of fast-food restaurants and convenience stores. Colorado Springs in El Paso County is not an easily traversable city and as a result is particularly affected by such food issues. This study seeks to measure the number of unhealthy food options within a walking distance of all the public schools in El Paso County and measure how such numbers are associated with variables representative of the ethnic and socioeconomic demographics of each school. By use of GIS maps and comparison of means tests this study demonstrated a significant difference in the mean number of minority students in a school zone with one or more fast-food restaurant or one or more convenience store, and the mean number of minority students in school zones with neither. A significant difference was also found in the mean number of students on free or reduced lunch in school zones with one or more fast food restaurant or one or more convenience store, and the mean number of students on free or reduced lunch in school zones with neither.

The rising rate of obesity in the United States is a serious health crisis that in particular threatens our nation's youth. Obesity, which is measured in body mass index, is related to dangerous health risks such as heart disease, diabetes, cancer and lower life expectancy (Rose et al. 2009). Urban areas in our country are particularly afflicted by this epidemic. Though the United States is a country with many options regarding food choice, access to healthy food is a debilitating issue for many people living in urban areas, where supermarkets are increasingly rare (Walker et al. 2010). Many urban areas in the United States have become flooded with an abundance of fast-food restaurants where large portions of calorie dense, but nutrient low foods can be purchased quickly and conveniently for affordable prices. This presents a health hazard that is hard to resist for low-income residents who are already disenfranchised by the limited access to healthy foods in cities in the United States (Glanz et al. 2005). A lack of education on good nutrition has similarly disenfranchised Americans, and even if there were better access to healthy food in our country, many Americans would still choose the more unhealthy options out of taste preference and convenience. As food preference develops early in one's childhood and generally influences one's preference as an adult, it is especially imperative that children develop healthy eating habits at a young age. In addition, given that childhood obesity is a predictor of obesity in adulthood, controlling childhood obesity needs to be a national health issue (Neumark-Sztainer et al. 1999).

The majority of children in the United States spend more time at school than in any environment other than home and thus consume a large percentage of their daily caloric intake at school. Therefore, schools could play a large role in helping fight childhood obesity. Schools should be taking important steps to incorporate healthy nutrition education into children's curriculum and making sure that nutritious foods such as fruits and vegetables are served as part of school lunches. However, school children are still regularly assaulted with a barrage of unhealthy food options such as snacks from vending machines and school stores and the plethora of fast-food and convenience store options that surround many urban public schools. In order to ensure that children are making and have the ability to make healthy food choices, schools need to use multifaceted approaches to address the health hazards that children regularly encounter. Given that school is such an important environment in children's lives, it is a particularly good place to study America's food crisis and how it can be addressed.

This study explored the obesity epidemic in the United States and how it is often related to poor diet and nutrition. This led me to researching the causes of the poor eating habits of many Americans and how they are related to both limited access to healthy foods and increased access to fast-food options. Considering the important impact of school on children's lives, my research turned to studying the response of schools to unhealthy eating and their efforts to encourage healthy diets for children. Within this literature, specific studies show that multifaceted intervention programs that familiarize children with healthy food options increase consumption of fruits and vegetables and reduce consumption of saturated fats and sugar.

GIS software was used to locate specific areas in Colorado Springs where public schools had multiple options of fast-food restaurants and convenience stores within a walkable distance of 0.33 miles. This data was used to find associations between having fast-food restaurants and convenience stores in a school zone and the ethnic and socioeconomic demographics of the schools. Because many public schools in urban areas

have open campuses where students have the liberty to walk around and explore other food options during free periods of the day they regularly and easily encounter food hazards during the school day. If the data provides evidence of inequities in Colorado Springs, possible solutions such as recommendations for future zoning of the city will be proposed.

Literature Review:

The literature regarding adverse health effects and their relation to diet and nutrition is staggering. In the United States, 16% of adolescents are overweight or obese, with 85% of obese adolescents becoming obese adults (Menschik et al. 2008). Poor nutrition has been linked to disease, behavioral problems, intellectual delays, child mortality, and the productivity of adults, showing that it is important to address early on in one's life (Rose et al. 2009). Communities with an abundance of fast-food restaurants are at a disadvantage, as research has shown that adults and children who eat fast-food have higher intakes of energy, fat, saturated fat, carbonated soft drinks, and lower intakes of vitamins A and C, milk, fruits, and vegetables than those who do not eat fast-food (Paeratakul et al. 2003). Many chronic diseases that disproportionately affect low-income groups, such as diabetes and obesity are linked to overconsumption of low-cost energy dense foods.

Ethnic minorities are disproportionately affected by the rising rates of morbidity, mortality, and adverse health outcomes. These unfortunate outcomes are often associated with factors such as residential segregation, poverty, and neighborhood deprivation (Walker et al. 2010). These health risks appear to be spatially structured, as African Americans live disproportionately in disadvantaged neighborhoods (Zenk et al. 2005). Research from the National Household Food Survey has shown that nutrient intakes are less likely to be adequate for the lowest income groups in America compared to the highest income groups. Low-cost energy dense foods are less expensive than healthier options, making them more attractive to low-income people (Morland et al. 2006). Research has shown that communities with better access to supermarkets and less access to convenience stores have healthier diets and are less likely to be obese (Stein 2011).

Unfortunately, residents of urban areas are systematically prevented from making healthy choices with food due to a severe lack of access to supermarkets in low-income areas. A resident of public housing in Scotland first used the term "food desert" in the early 1990s, to describe "poor urban areas, where residents cannot buy affordable, healthy food" (Walker et al. 2010). Economic segregation became prevalent in cities in the United States between 1970 and 1988 and was accompanied by a migration of affluent people to city suburbs. This residential segregation caused the median household income in inner cities to go down and resulted in the closure of almost half of the supermarkets in the three largest cities in the United States. Walker et al. (2010) found that the lowest income neighborhoods in the United States had almost 30% fewer supermarkets than the highest income neighborhoods. Though research has shown that African American adults' produce intake increased with each additional supermarket in a census tract, healthy foods such as low-fat dairy and produce are less available and of poorer quality in minority and low-income neighborhoods (Glanz et al. 2005). Within the literature regarding food deserts, studies have shown that the most impoverished black neighborhoods in Detroit were 1.1 mile farther from the closest supermarket and had 2.7 fewer supermarkets within a three-mile radius compared to the most impoverished white

neighborhoods. In addition 23-28% of African American residents in the most impoverished neighborhoods did not own a car in 2000, further limiting their access to healthy food (Zenk et al. 2005). This spatially structured inequality is common and evident in many urban areas of the United States.

In addition to a lack of access to healthy food options, many urban areas are disproportionately flooded with unhealthy, but cheap and convenient food options. A “food swamp” is an area where “socially disadvantaged individuals encounter an overabundance of unhealthy food outlets” (Stein 2011). The number of fast-food restaurants has risen from 30,000 in 1970 to 232,611 in 2015 and consumption of food away from home is linked to increased portions and foods higher in fat and saturated fat and lower in fiber and calcium than foods prepared at home (Statista 2015). Neighborhoods with a greater abundance of fast-food restaurants and a higher ratio of fast-food to non-fast-food restaurants are more likely to have residents with a higher body mass index and a greater risk of being obese (Stein 2011). Austin et al. (2005) found that almost half of the food spending in the United States goes towards foods eaten away from home. Lin and Frazao (1999) found that away from home foods provided 34% of the total caloric intake in 1995 as opposed to the 18% they accounted for in 1977-1978 as well as an increase in proportion of meals away from home from 16% to 29%.

Fast-food restaurants are more common in minority neighborhoods than in predominately Caucasian neighborhoods, and supermarkets are less common (Glanz et al. 2005). In addition, convenience stores and small grocery stores as well as fast-food restaurants locate disproportionately in low-income areas (Rose et al. 2009). Morland et al. (2006) found that the presence of supermarkets was associated with a lower prevalence of overweight, obesity, and hypertension. People who lived in areas with one of more supermarket had a 9% lower prevalence of overweight, a 24% lower prevalence of obesity, and a 12% lower prevalence of hypertension than people who lived in areas without any supermarkets (Morland et al. 2006). In addition, the presence of convenience stores was associated with an increased prevalence of overweight, obesity, and hypertension (Morland et al. 2006). Many low-income areas that do not have supermarkets instead have convenience stores and small grocery stores where the food is generally more expensive and less healthy (Donkin et al. 1999). People living in areas where supermarkets and convenience stores are the only types of food stores available were found to have a 35% higher prevalence of obesity compared to people who live in areas where supermarkets are the only food stores available (Morland et al. 2006).

Maintaining a healthy diet is generally associated with a more expensive lifestyle. Hendrickson et al. (2004) found that food costs are higher than the average market basket prices in areas with the highest poverty levels, and that the lowest income households pay more for food than higher income households. Taking six food products that researchers had determined were essential components of a healthy diet, Donkin et al. (1999) found that it was possible to spend as much as 4.5 times as much on certain products as the lowest price, depending on where one shops, showing that food is more expensive in convenience stores and small grocery stores than in supermarkets. Their study showed that foodstuffs cost 24% more in small stores than supermarkets on average, meaning that a household on benefits would have to spend 25% more of their income on food if they did not have access to a supermarket. In addition, less than a third of the foods that would make up a healthy diet were available in most outlets (Donkin et al. 1999).

Studies have shown that children develop lifelong eating behaviors at a young age. Though being overweight as an adolescent is associated with being overweight as an adult, many young people have a lack of urgency regarding their future health. However, high fat intake and low dietary calcium intake as an adolescent is associated with increased risk for heart disease and low bone density as well as the possibility of osteoporosis later in life, respectively (Neumark-Sztainer et al. 1999). Social Cognitive Theory tells us that one must consider the effect of the environment on one's behavior, as people generally learn new behaviors by replicating those of others. Thus environment has a large influence on dietary behavior and availability of food will be associated with greater consumption if the food is perceived as tasting and looking good (Neumark-Sztainer et al. 1999). In a survey of 141 male and female seventh and tenth graders in inner-city schools in Minnesota, Neumark-Sztainer et al. (1999) found that the most influential factors on food choices were hunger, taste, time available, and convenience.

The majority of children in the United States spend more time at school than in any other environment other than home. Therefore, it is important to understand the response schools have made and are making to ensure that children begin making healthier food choices. A large problem in providing children with healthy food options in school is the prevalence of competitive food options such as vending machines and school stores that give children unhealthy alternatives to school lunches. Though federally subsidized school meals are required by congress and the USDA to meet nutrition standards, competitive foods, or a la carte options, do not. The third School Nutrition and Dietary Assessment Study found that 17% of elementary, 82% of middle, and 97% of high schools have vending machines, and that 85% of schools have a snack bar at which to buy food or beverages such as sodas and high-fat snacks (Story et al. 2009). Researchers Kubik et al. (2003) found that competitive food options in schools are inversely associated with daily fruit and vegetable consumption and are positively associated with daily total fat and saturated fat intake. Vending machines specifically were found to be negatively associated with fruit consumption (Kubik et al. 2003). Body mass index of students was found to increase by 0.10 BMI units for each additional food practice permitted (Kubik et al. 2003).

As demonstrated in the studies related to Social Cognitive Theory, it is important to familiarize children with fruits and vegetables at an early age. This can be done quite effectively in a school environment. Researchers Cullen et al. (2005) found that the availability of fruits and vegetables in school cafeterias was a significant predictor of fruit and vegetable consumption. Many school studies use multifaceted intervention programs that increase options of fruits and vegetables in school, make the produce selection more attractive, vary the preparation, and give students positive feedback for choosing fruits and vegetables with their meals. In their study of an intervention program, Reynolds et al. (2000) found that the mean daily consumption of fruits and vegetables were higher for the parents of students in the intervention programs compared to the parents of students in the control groups. It would seem that the best way to increase fruit and vegetable consumption is through multifaceted intervention programs.

An interesting way for students to learn about food systems, the connection between food and the environment, and to promote healthy eating in children is through the implementation of school gardens. In the late 1990s, Delaine Eastin, California's Superintendent for Public Instruction, called for "a garden in every school" and passed

legislation providing small start-up funds for schools interested, resulting in more than 2000 school gardens used for academic purposes in California (Ozer 2007). Within the literature regarding school gardens, studies have found positive benefits in children in response to their implementation. In the United States, children consume an average of 3.5 servings of fruits and vegetables a day, which is below the national recommendation of 5 a day (Morris et al. 2001). This study once again demonstrates the importance of exposing children to healthy food options at a young age, as the earlier they are introduced to healthy eating the more likely they are to continue good dietary habits.

With the plethora of unhealthy food options available to children both inside and directly outside of their schools, a study was designed to find health hazards within walking distances of public schools in El Paso County, such as fast-food restaurants and convenience stores. Each fast-food restaurant and convenience store presents a health hazard to students for several reasons, but particularly because of the severe health issues that have been associated with unhealthy eating. If the data were to show associations between schools with large populations of students on free or reduced lunch or minority students and the number of fast-food restaurants and convenience stores within a walking distance, it would be evident that public schools in disenfranchised areas of El Paso County are unevenly barraged with food health hazards.

Methods:

A study was designed to quantify the number of unhealthy food options available within a walking distance of 0.33 miles of each public school in El Paso County, and show any associations that may exist with the ethnic and socioeconomic demographics of the students. To do this, information on fast-food restaurants and convenience stores in El Paso County from the U.S. Businesses Database was downloaded from ReferenceUSA.com. Using the advanced search option “fast-food” was searched for and all of the options under “foods-carry out” and “hamburger & hot dog stands” were downloaded that qualified as limited service chain restaurants. This data was brought into the GIS software program ArcMap 10.3.1 where it was geocoded and spatially mapped. Using the same search option in the U.S. Businesses Database “convenience stores” were searched for and data on all of the convenience stores in El Paso County was downloaded. This data was brought into ArcMap 10.3.1 where it was geocoded and spatially mapped.

To gather data on schools in El Paso County, the Elementary/Secondary Information System from the National Center for Education Statistics was utilized. Using the table generator tool data for all of the 2013-2014 school year in El Paso County was retrieved, which contained the addresses of every public school in the county. The school data contained the street address of every public school, the racial demographics of each school, and the total number of students on free or reduced lunches, a variable representative of class. The school information data was brought into ArcGIS Online. Using ArcGIS Analysis, “Create Drive-Time Area” tool was utilized to create a buffer zone of walking distance of 0.33 mi surrounding every public school in El Paso County. A walking distance of 0.33 mi was chosen because it seemed like a realistic walking distance for students with limited free time in their schedules. The Create Drive-Time Area tool uses a fixed walking speed of 3.1 miles per hour (5 kilometers per hour) and creates a polygonal buffer zone following pedestrian walkways and designated streets, ignoring rules irrelevant to pedestrians such as one-way streets. This is more pertinent to

the study than standard circular buffer zones, because those do not show obstructions such as highways, that would prevent a student from accessing a fast-food restaurant or convenience store. After creating buffer zones in ArcGIS Online, the school data was brought into ArcMap 10.3.1, where it was geocoded and spatially mapped.

Next, the restaurant data and the convenience store data were both spatially joined to the school data, providing a count number of fast-food restaurants and a count number of convenience stores in each school buffer zone. Four maps were then created that showed visually the number of fast-food restaurants or convenience stores in each school buffer zone. This data was then brought into the data analyzing software STATA. In STATA, a dummy variable for schools with one or more fast-food restaurant in its buffer zone and a dummy variable for schools with one or more convenience store in its buffer zone were created. The school zones were classified into two groups, those with no fast-food restaurants and those with one or more. The same classification was created for the presence and absence of convenience stores. From the school data, variables for the percent of students on free or reduced lunch, percent minority students, percent Latino students, percent African American students, and percent Caucasian students were created. The variables were tested for normality by making histograms and running tests for skewness and kurtosis. They were then tested for unequal variance between groups by comparing each group's standard deviation.

Comparison of means tests were then run using two-sample t-tests on each of the five interval variables for both of the dichotomous fast-food and convenience store groupings. After running t-tests for all of the variables, Wilcoxon (Mann-Whitney) rank sum nonparametric tests were run as a check on the t-test results because of certain violations of assumptions. All of the Wilcoxon tests confirmed the results of the t-tests. Cohen's d was then calculated to provide a measure of effect size reported in conjunction with the results of my t-tests. As statistical significance does not explain anything about effect size and the magnitude of what is shown by a t-test, it is important to calculate Cohen's d to see if the difference observed is likely occurring in a larger population. Cohen's d is calculated by subtracting the mean of the second group from the mean of the first group and dividing the difference by the pooled standard deviation for the samples.

Cohen's d equation:

$$d = \frac{M_{group1} - M_{group2}}{SD_{pooled}}$$

The equation produces two values, Cohen's d and Cohen's d corrected for uneven group. The second value is the pertinent one. A value between 0-.19 is considered a small effect, between 0.2-0.49 is considered a medium effect, and 0.5 and above is considered a large effect. Lastly, complimentary illustrative boxplots and tables displaying the values were created. The boxplots and tables help explain visually the difference in means of minority students and students on free or reduced lunch across school buffer zones containing no fast-food restaurants or convenience stores and school buffer zones containing one or more of either. The boxplots and tables also showed the effect sizes and statistical significance of the findings.

Results:

See Map 1.

See Map 2.

See Map 3.

See Map 4.

As seen in Table 1, the initial t-tests showed that the mean level of students on free or reduced lunch for school buffer zones containing one or more fast-food restaurant (M=52.67) is significantly higher than the mean level of students on free or reduced lunch for school buffer zones containing no fast-food restaurants (M=41.45). The mean level of minority students for school buffer zones containing one or more fast-food restaurant (48.65) is significantly higher than the mean level of minority students for school buffer zones containing no fast-food restaurants (M=38.96). The Cohen's d tests, adjusted for unequal groups, demonstrated a medium effect size of fast-food restaurants on the mean level of students on free or reduced lunch (d=0.44) and a large effect size of fast-food restaurants on the mean level of minority students (d=0.51), as shown in Table 1.

See Table 1.

See Graph 1.

As seen in Table 2, the mean level of students on free or reduced lunch for school buffer zones containing one or more convenience store (M=57.75) is significantly higher than the mean level of students on free or reduced lunch for school buffer zones containing no convenience stores (M=39.39). The mean level of minority students for school buffer zones containing one or more convenience store (M=54.52) is significantly higher than the mean level of minority students for school buffer zones containing no convenience stores (M=36.77). The Cohen's d tests also showed a medium to large effect size of convenience stores on the mean level of students on free or reduced lunch (d=0.74) and a large effect size of convenience stores on the mean level of minority students (d=0.99), as shown in Table 2.

See Table 2.

See Graph 2.

The standard deviation variance tests were consistent with the initial t-tests. Running the Wilcoxon (Mann-Whitney) rank sum tests confirmed the t-test results that the distribution of the groups was different. The statistical significance of the t-tests shows that as the number of fast-food restaurants and convenience stores in a school buffer zone increases from none to one or more, the percentages of minority and free or reduced lunch students increase. Additional t-tests were run on the variables percent African American students, percent Latino students, and percent Caucasian students. The mean percentage of Caucasian students decreases if the school buffer zone contains one or more fast-food restaurant or convenience store. The mean percentages of Latino and African American students increase if the school buffer zone contains one or more fast-food restaurant or convenience store. The number of fast-food restaurants and convenience stores in a school buffer zone is only a representation of some of the health hazards that are within a transferable distance from the school locations. Outside of the polygons created for this study are many more hazardous health options that are likely easily accessed by students.

Discussion:

The findings of this study have helped show that schools with higher percentages of low-income students and ethnic minorities are more likely to be exposed to unhealthy living conditions such as high densities of fast-food restaurants and convenience stores.

The comparison of means tests run for this study showed with statistical significance that as the number of fast-food restaurants and convenience stores in a school buffer zone increases from none to one or more, the percentages of minority and free or reduced lunch students increase. Though it is difficult to change the structure that is already in place, the city of Colorado Springs is going to continue to expand and sprawl through the coming years and as a city, Colorado Springs should take steps to prevent unhealthy food options from being built in school zones. Colorado Springs is the most populous city in El Paso County and the second most populous city in Colorado. Located 60 miles south of Denver, the city contains the United States Air Force Academy and has an economy driven mostly by military, high-tech industry, and tourism. According to a 2014 estimate, Colorado Springs has a population of 445,830. 2010 census data shows that the population is approximately 78.8% white, 6.3% African American, and 16.1% Latino (United States Census Bureau, 2015). The phenomenon of fast-food restaurants and convenience stores being located within walking distances of schools with a higher percentage of minority and low-income students has much to do with policy. This same issue is not seen as much in the higher-income areas of Colorado Springs, because those wealthier residential areas such as Briargate and the Broadmoor areas are not zoned for commercial businesses.

Policy changes involving zoning and licensing could help limit the density of retailers providing unhealthy resources to residential neighborhoods and the public schools in them. Zoning and licensing are both forms of police power, which is the authority of state governments to regulate in order to protect the welfare of the public (Wooten et al. 2013). Policy makers could use intervention techniques in areas referred to as food deserts and food swamps to address such inequities that have been shown to predict chronic disease. These sorts of policy interventions are important because the codified regulations they create and put in place last beyond changes in public leadership and the government can ensure retailers comply with regulations and enforce rules. In addition, local governments can use zoning to shape and control land use and thereby the built environment by governing what buildings can be built and what they can be used for (Wooten et al. 2013). Zoning divides the city into different zones to be used for different purposes, such as residential, commercial, and industrial areas, and then creates limits such as only houses can be built in residential zones. Future development in Colorado Springs could be improved by not allowing for public schools and fast-food restaurants in the same zones. Conditional use permits can be attached to zoning laws that set conditions on use of land if it could have negative effects on public health. Any regulations created on land by zoning laws continue on with the land regardless of ownership changes, and the government can always make new owners comply with the law.

Licensing is another tool the government can use to regulate business, by giving businesses permission to sell things that would be illegal without a license and setting conditions that businesses must comply with. For example licenses could require retailers to carry a minimum of healthy foods, such as a minimum area of square footage to be occupied with fresh produce (Wooten et al. 2013). Many communities in the country have used zoning to restrict locations of certain types of business. For example, Concord, Massachusetts does not allow for any fast-food or drive-through restaurants (Wooten et

al. 2013). Other communities have limited the number of fast-food restaurants allowed, or require certain distances between each fast-food restaurant to prevent neighborhoods from becoming food swamps. In most states liquor stores and adult businesses cannot be located near schools. Perhaps this same technique could be used to prevent fast-food restaurants and convenience stores from locating around public schools in Colorado Springs. Chronic disease prevention has not traditionally been used as a reason for zoning. A recent study showed that 93% of the communities examined allowed for fast-food restaurants in their zoning codes (Wooten et al. 2013). In 2011, Los Angeles created a policy limiting new fast-food restaurants in South Los Angeles, a practice the city of Colorado Springs could enact as well, for inevitable future development.

A 2010 study of zoning ordinances from 175 communities surround 154 public middle and high schools showed that low-income communities are significantly less likely to allow supermarkets than high-income communities. In addition, zoning codes were twice more likely to allow farmers markets in higher-income communities than in lower-income communities. Almost all of the communities studied allowed for fast-food restaurants, but few communities allowed for farmers markets or community gardens (Bridging the Gap 2012). We need to influence policymakers about policies that protect the public's health. In order to do this we need to encourage our policymakers to see zoning and licensing as ways to promote health and use them to explicitly allow supermarkets and prohibit fast-food restaurants and convenience stores in specific areas such as school zones. This would prevent convenience stores and fast-food restaurants from locating around schools in a way that is hazardous to children. In addition, conditional use permits could be used to require restaurants to improve the quality and reduce the portion size of their foods if they are to stay in jurisdiction. With 79% of Americans living in urban areas, it is important for the government to regulate the use of land in a way that considers the health and welfare of the people in its jurisdictions.

School policy preventing the allowance of vending machines and other competitive food options is also important, as students of schools with less access to unhealthy food options were found to consume fewer unhealthy foods (Kubik et al. 2003). Many school food service directors feel that the \$2.47 federal reimbursement for free school lunches is not adequate and thus feel the need to sell competitive food options. Many food service directors fear that restricting competitive food options will decrease school revenue, yet this has not been shown in studies (Kubik et al. 2003). Cullen et al. (2005) found that when chips and dessert foods were removed from snack bars consumption of sweetened beverages decreased and intakes of milk, calcium, and vitamin A increased. In addition the frequency of chips and desserts consumed from vending machines, as well as intakes of saturated fat and sodium increased. We need policy changes in all parts of the student environment in order to change student consumption, as students will often find ways to compensate and get unhealthy food options from other outlets. Schools should all try to implement intervention techniques such as those in the studies cited. It is evident that the most successful intervention techniques are ones that use multifaceted programs and experiments. These intervention techniques also provide opportunities for farm-to-school programs that would connect schools to local farms to provide local and healthy foods in cafeterias as well as provide health and nutrition education. This could help connect well-being with a student's

capacity to learn and would be low-cost with many benefits. These could be hard to implement as global competition and trade policies favoring large farms have created hardships for small farms in recent years. However, with the number of small farms decreasing, it is in the interest of small farms to join in partnerships with schools. The Federal Fruit and Vegetable Program implemented by the USDA in the 2002 Farm Bill gives grants to schools to buy fruits and vegetables (Kubik et al. 2003).

Colorado Springs Food Rescue is a local organization that rescues unused, edible food from grocery stores and other outlets that would otherwise be thrown away, and distributes it to Colorado Springs residents living in disenfranchised areas. They deliver food to 14 recipient sites across the city and rescue an average of 25,000 pounds of fresh food each month. Once delivered to the recipient sites, there are leaders who live in the community, called “Promotores”, in charge of equally distributing the fresh produce and other food items to the community. A recent venture of Colorado Springs Food Rescue is their partnership with Atlas Preparatory, a charter school in Colorado Springs. In this collaboration, Colorado Springs Food Rescue staff, Colorado College students, Atlas Preparatory high school students, and Atlas Preparatory staff manage a food program that delivers fresh food to families on a weekly basis. Providing food for families in need is a unique way of getting students to learn about local food issues regarding access and health. In addition, exposing students to fresh produce and healthy foods is a great way to start introducing those foods into their diets. As referenced earlier, the literature regarding school gardens and other intervention techniques demonstrates the importance of exposing children to healthy food options at a young age. Combining the importance of exposure to healthy food with the importance of serving the community and avoiding potentially harmful foods is a good way for students to begin learning about healthy eating habits, a model more schools should follow.

Conclusion:

The study showed that in El Paso County, the number of students on free or reduced lunch for school buffer zones containing one or more fast-food restaurant and for school buffer zones containing one or more convenience store is significantly higher than number of students on free or reduced lunch for school buffer zones containing neither. The number of minority students for school buffer zones containing one or more fast-food restaurant and for school buffer zones containing one or more convenience store is also significantly higher than the number of minority students for school buffer zones containing neither. This evidence demonstrates serious spatial inequities in exposure to health hazards in the city of Colorado Springs that are not as evident in school zones with fewer percentages of minority students or students on free or reduced lunch. Evidence of such inequities could be used to influence future policies regarding city planning and zoning as well as to influence school policies encouraging healthy eating habits and discouraging unhealthy ones.

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